

A  
DISQUISITION  
ON  
REMEDIES  
WHICH DISSOLVE THE  
STONE,  
IN THE  
KIDNEYS, or HUMAN BLADDER.  
WHEREIN THE DIFFERENT  
MEDICINAL SUBSTANCES and COMPOSITIONS,  
RECOMMENDED FOR THIS INTENTION,  
ARE IMPARTIALLY SCRUTINIZED;  
AND THEIR RESPECTIVE  
LITHONTRIPTIC VIRTUES  
ASCERTAINED.

Translated from the original LATIN of the late celebrated  
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DISQUISITION

ON

LITHONTRIPTIC MEDICINES.

**T**HE Stone being a very terrible and frequent distemper, it is not to be wondered at, that numerous attempts have been made to discover a remedy capable of dissolving it.

It appears from an experiment made by the celebrated Boerhaave,\* that the primary elements of the stone have been dissolved in healthy animal fluids, which afterwards, in an united state, form hard stones. These elements, while they remain separated from

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\* He filled a cylindrical glass, nearly the diameter of a man's middle finger, with the urine of an healthy young man, perfectly free from any calculous complaints, and whose family had never been subject to this disorder. While the urine was still warm and quite clear, having been made after a good night's rest, before breakfast, he examined it with a microscope, but could not discover the least heterogenous substance.

This urine was exposed to the open air, in mild weather (the Fahrenheitian thermometer then being at 72 degrees) and the mouth of the glass only covered with paper, to keep out the dust.

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from each other, no ways injure health ; they only become hurtful when united. Hence this disorder would be radically cured, were a remedy known, capable of separating the accreted calculous elements, and dissolving them again in the circum-ambient fluid, from which they were originally formed, whereby they might be evacuated with the urine.

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In about seven minutes and a half he examined the urine again, with the microscope, which now appeared full of corpuscles, resembling little bits of wool, which moved rapidly up and down the glass, some ascending, while others descended, and so *vice versa* ; whence the corpuscles seemed to be of equal weight.

Presently afterward, something whitish appeared in the urine ; and fatty streaks, like those which are observed when spirit of wine is gradually mixed with water. While he was examining this new phenomenon with the microscope, a cloud was formed from these streaks, which at first floated pendulous throughout the whole glass, but gradually receded from the sides, and collected itself towards the axis.

The little flocks, resembling wool, began now to disappear, and were collected into a cloud, which every moment becoming thicker, at length subsided to about half an inch from the bottom of the glass, which was six inches deep : the superior part of the cloud reached within an inch of the exterior surface of the urine.

This cloud, examined with the microscope, seemed replete with very minute shining atoms ; and the like particles began to adhere to the sides and bottom of the vessel. These atoms, at first white, grew reddish in about half an hour, then changed to a deeper colour, and in about two hours became of the same colour as the sand deposited at the bottom and sides of a chamber-pot, wherein urine has been left for some time. But these elements of a growing stone remained so entangled with the cloud, that they did not subside to the bottom of the glass, but assumed the form of a brownish cloud.

However, by degrees some of these corpuscles increased so much in size, that they fell to the bottom ; and at the same time, in the uppermost part of the urine, similar atoms concreted, which also, upon gently shaking the glass, quickly subsided. In the same manner these atoms grew larger, all round the sides of the glass, and in twenty-four hours time became as large as mustard seeds. Their shape was that of a rhombus, with equal and obtuse opposite angles ; other parallelipid corpuscles, redder and larger, intersected them : square corpuscles, but very few in number, sometimes also intersected them.

Boerhaave

To fulfil this intention many remedies have been tried, by applying them to human stones, out of the body ; but I believe spirit of nitre alone is capable of perfectly dissolving the human stone, which it effects with a considerable effervescence, as Hoffman observes. But it is apparent, that such a corrosive menstruum cannot be applied to the stone existing in the body ; because it must absolutely destroy the parts wherein the stone might be lodged. Van Helmont well describes the requisite qualities of a lithontriptic medicine. “ It readily changes into urine, “ that it may reach the affected part. It possesses the “ property of dissolving the union of the component “ parts of the human stone. It is friendly to nature, “ that it may not ruffle the constitution. It is the gift “ of God, not prepared by human art, but only separated and forced out by means thereof. It is “ extremely subtle, to enable it to destroy its object “ afar off. It possesses these virtues specifically, and “ not from its second qualities ; for such are com-  
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monly

Boerhaave never observed that corpuscles as large as those which were formed on the bottom and sides of the glass, con- creted in the urinary cloud.

These rhomboidal atoms were here and there affixed together sideways, so as to become large, from the attachment of six such bodies to each other.

This rhomboidal shape of the elements of the human stone is also confirmed by Peyrescus, as Gassendi observes.

From the above experiment it evidently appears, that the human stone is produced by granulation, not from different elements, or a confused mixture of concreting humours, but solely by the apposition of similar elements ; and, contrary to the opinion of Van Helmont, its generation is successive, not instantaneous.

Also if the smoothest pen is dipped in fresh made healthy urine, a shell of soft sand accretes thereto, which increases in quantity by the addition of other urine. Thus stones may be generated out of the body, the calculous elements adhering, as to a basis, to any solid body they meet with in the urine, as the celebrated Nuck has demonstrated by an experiment he made on a dog.



“ monly deceitful. They err who ascribe these pro-  
 “ perties to corrosives alone : for neither does the  
 “ ostrich digest iron, nor fowls pearls, little stones,  
 “ &c. by corrosion, but by a particular power of dis-  
 “ solving hard bodies, and tartareous concretions.”  
 No wonder Helmont believed the stone might be dis-  
 solved, for he boasted that he was possessed of the  
 Alcahest or universal solvent, which so perfectly dis-  
 solved all substances, that it caused them to flow like  
 water. Moreover the learned Cardan says, “ that  
 “ in his time a man travelled through Lombardy,  
 “ who cured all diseases, safely, certainly, and quick-  
 “ ly, with a certain potion,” and adds, “ that he  
 “ firmly believes this person is now in hell, for not  
 “ having revealed his secret in his last moments, for  
 “ the good of posterity.”

But as there is no certainty that such a medicine  
 has really existed, capable of perfectly dissolving the  
 stone, and yet of such a mild nature as no ways to  
 injure the part wherein the stone may happen to  
 be lodged, the most skilful of the profession have ta-  
 ken into consideration, whether the stone may not un-  
 dergo such a change, as readily to crumble to pieces,  
 and thus be easily evacuated from the body.

The human calculus is not a simple homogeneous  
 body, the component parts whereof are entirely simi-  
 lar, because composed of such, but upon a chemi-  
 cal analysis, yields the same products as other ani-  
 mal bodies, viz. volatile salt, phlegm, and oil, a  
 black friable caput mortuum remaining, which when  
 all the empyreumatic oil is consumed by calcination,  
 leaves an earth no longer cohering.

Hence it was reasonably enough imagined, that if  
 any of the constituent parts of the human stone could  
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be separated from the others, the cohesion of the rest must be diminished, and thereby the stone rendered friable. Now as the volatile salt is expelled from a stone, by means of fire, more quickly than the other parts, the separation thereof from the rest was principally expected; and as lime, when mixed with sal armoniac, instantly emits a subtle, volatile, alkaline spirit, and the same phenomenon ensues when it is mixed with human urine, quick lime has a long while been considered as a lithontriptic: for Bartholine says, "It is clear from the authority of Basil Valentine and others, that nothing exceeds spirit of quick lime in its lithontriptic virtues; and I have repeatedly experienced, that strong lime-water, made from the shells of crustaceous fishes, generally dissolves human stones, out of the body, into a jelly, when digested therein a few days with a gentle heat." One Dickenson, a celebrated English chemist of the last century, also extols, as an extraordinary medicine in the stone, a water distilled from the antinephritic plants boiled some time with a quantity of egg-shells thoroughly calcined.

Other medical professors have judged, that the cohesion of the parts of the stone might be destroyed, by separating the earthy particles from the rest; as earth is the principal cause of the stability of bodies, and resists a very intense degree of fire.

Hales has demonstrated, by his most excellent experiments, that air is firmly united to all vegetable, animal, and mineral substances, and makes a considerable part of their bulk, and coheres so strongly to the other component parts, that an intense fire is required to dissolve their union. Air, while thus contained in bodies, is unelastic; but as soon as separated from the other parts of a body, it recovers its primitive elasticity, and expands itself. Now above one half



half of an human stone consists of mere air, a larger quantity than is contained in any other known substance, whether animal, vegetable, or mineral.

If, therefore, the contained air can be expelled from the human stone, its size, of course, must be considerably lessened : moreover it seems highly probable, that the inelastic air intimately mixed with the whole substance of the stone, when having regained its pristine elasticity, it escapes from the stone, may force the adjacent particles out of their original places, as it suddenly expands itself : for the fixed air of a human calculus, not more than three-quarters of a cubic inch in size, when forced out by means of fire it became elastic, filled the space of 516 cubic inches. What a prodigious difference ! Whence not only the bulk of a stone must be lessened by the expulsion of the air, but also the cohesion of its component parts with one another must be weakened, and the stone be thereby rendered brittle.

But Hales demonstrates that all human stones do not part with their fixed air with equal facility. The same is also confirmed by the experiments of Lobb, who affirms that a stone may be dissolved by every thing capable of separating and expelling the particles of fixed air contained therein ; because that the particles of air being intermixed with the other component parts of this concrete, by the loss of them, vacant spaces must be left between the other component particles ; that is, the stone must crumble to pieces. He steeped flint stones and bits of marble in the juice of lemons ; presently air-bubbles issued from these substances, resembling the froth upon the surface of liquors, which for several hours constantly increased in quantity ; and at the same time, a fine, light, white powder subsided to the bottom of the glass. Whence he draws this conclusion, that the dissolution



tion of the above stones was effected, in consequence of the acid particles of the lemon juice having destroyed the union between the air and the other component particles of these substances; and he thinks it probable that these particles of air were what cemented together the other parts. From the ingenious experiments of Stack, a famous Swiss physician, Lobb, upon mature deliberation, concluded that all animal stones abound greatly in a viscid, inelastic matter, analogous to mucilage of quince-seeds; and that every thing capable of rendering the air latent therein, elastic, is a real dissolvent of the stone.

Macbride, an eminent English physician, has proved from conclusive experiments, that this inelastic air contributes greatly towards cohesion, especially in animal and vegetable substances: he even thinks that fixed air is the primary cause of the cohesion of the elements, as they do not separate from one another before this air has been extricated.

This cohesion of the inelastic air with the other constituent parts, is often so strong, as to require a considerable degree of fire to dissolve its union; and such bodies may be kept unchanged for many ages. Hales extracted by fire a large quantity of air from stag's horns; but this air was not extricated from its union with the other parts without a very strong fire; when white fumes issued from the receiver, the air separated in great quantity, as also when the fetid empyreumatic oil was forced out by a most intense fire. Moreover, every body knows that the horns of deer, killed many ages ago, are still preserved in the halls of country gentlemen. On the contrary, where the inelastic air is separated by fermentation or putrefaction, the cohesion is diminished, nay sometimes wholly lost; but if this inelastic air can be restored to  
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the bodies from which it has been extricated, they cohere together again, as firmly as at first.

Macbride steeped some putrid flesh, almost dissolved into a stinking gore, in some wort, then strongly fermenting : in less than an hour the flesh smelt much less offensive, and in five hours became quite sweet ; and though it before scarcely cohered, was now again firm : the same effect followed, when a piece of rotten meat was hung over the steam of fermenting wort. It is an indisputable fact, that a large quantity of air is generated by liquors in a state of fermentation, which air was before inelastic : this Helmont calls the *gas sylvestre*, which when taken in with the breath, in a considerable quantity, instantly suffocates men and animals : now this identical vapor destroys putridity, and strengthens the cohesion weakened thereby, the air, as it seems, being restored, which, from putridity was separated, and had escaped from its union with the other parts. Bodies when deprived of their fixed air seem bibulous, and greedily imbibe similar air, and fix it again : for it appears from the experiments of Hales and others, that this fixed air, now rendered elastic, sometimes soon loses its acquired elasticity, and is again fixed in other bodies, destitute of such fixed air.

Calcareous earths abound in such fixed air, and have a great affinity therewith ; but when deprived of this fixed air, from calcination, become caustic, and readily dissolve in water ; but when this fixed air is restored, they lose their caustic quality, and no longer dissolve in water, as is demonstrated by a very curious experiment. Let lime water, filtered through paper, be poured into a glass vessel : in another glass vessel put a quantity of pearl ashes ; join these vessels together by means of a crooked glass tube, the ends of which fit the necks of the two glasses so nicely, that  
nothing



nothing can escape through the joints. In the top of the vessel that contains the pearl ashes, bore a hole, to which apply the pipe of a small funnel, through which gradually pour in oil of vitriol, or any other acid, to cause an effervescence. As soon as the mixture begins to effervesce, remove the funnel, and stop the hole, that the air, separated during the effervescence, may be compelled to pass through the connecting tube, into the glass containing the lime water. This done the lime water will grow turbid in a few minutes, and the lime will subside to the bottom, which upon pouring off the water, will strongly effervesce with oil of vitriol.

Some phenomena are hence comprehended, that have puzzled the greatest chemists. Volatile alkaline spirits distilled with quick lime, never produce volatile alkaline salt in a solid form, because they are destitute of fixed air, the band which cements particles together : nor do they cause an effervescence when mixed with acids, a circumstance still more surprising. The reason of these phenomena is as follows : Quick lime, when added to sal armoniac, not only attracts the acid, but also the fixed air contained in the sal armoniac, wherefore, in distillation, the volatile salt alone is raised with the phlegm deprived of its fixed air. Now as effervescence is produced by the separation of the fixed air, and its regaining its elastic property, by the union of an alkali with an acid, hence alkaline salt, deprived of all its fixed air by quick lime, cannot of course effervesce with acids. Hence such volatile alkaline spirits, if again saturated with fixed air, would effervesce with acids. This is the case in fact, as the above plain experiment demonstrates. For when, in the apparatus, the air forced out by means of the effervescence between the acid and alkali, is compelled to pass through the crooked tube into the vessel containing the volatile al-

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caline

caline spirit with quick lime, the spirit, within ten minutes, becomes so saturated with the fixed air which it attracts, that it will now cause a strong effervescence with acids. The very same effect is produced, when air, extricated from liquors in a state of fermentation, is, by the like artifice, derived into a glass vessel, containing an alkaline volatile spirit with lime. Besides, the same air extricated by fermentation, received into lime water, precipitates the calcarious particles, whence, in the space of five days, three grains of such earth was produced from six ounces of lime water.

But though fixed air becomes elastic, when its connection with the other parts of a substance is dissolved, it differs in its properties from the air of the atmosphere, and in particular is more quickly and readily imbibed by bodies deprived of fixed air. For fixed air separated by means of effervescence, in ten minutes time rendered volatile alkaline salt capable of effervescing with acids. The same air extricated through fermentation, in the space of five days precipitated the calcarious particles from lime water, which though left in an open vial a whole fortnight, exposed to the air of the atmosphere, had not deposited, during that time, a single grain of calcarious earth. Yet fixed air seems to exist in the air of the atmosphere, or the circumambient air may be rendered inelastic. For we observe that lime water, when long kept, collects a scum on its surface, which is in reality calcarious earth, which, by the action of fire, may again be converted into quick lime. Moreover, lime long exposed to the air, loses its caustic quality, and is no longer soluble in water. Nieuman kept spirit of sal armoniac prepared with quick lime, ten years, which having almost lost all its volatility, strongly effervesced with acids; because in this great length of time, the spirit had again become saturated with fixed air, which is absolutely necessary to cause effervescence.

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The celebrated Boerhaave, who never determined readily in cases the least doubtful, says, " It has sometimes been doubted whether all that might be thus generated would be so far of the same nature, as that it ought to be called by the same name of elastic air? or, on the other hand, whether bodies being reduced, after a certain manner, into their minutest particles, might not have their nature altered, and, by a real transmutation, be changed into this elastic air, which afterwards being again concreted with other things, might produce new solid bodies? and consequently, whether, besides the common elastic air, there was not in nature something else very much resembling it, and yet not perfectly the same."

The ingenious and accurate experiments of Dr. Black, concerning the fixed air, latent in bodies, merit an attentive perusal; moreover Macbride supposes them previously known, in order to the better understanding of his own.

Now as the quantity of fixed air contained in a human stone constitutes above one half of its own bulk, there is great reason to suppose that a stone may not only be much lessened in size, from the expulsion of this air, but also be rendered friable; as the preceding experiments demonstrate that this fixed air contributes greatly to the cohesion of bodies. It is well known that the air is expelled from the human calculus by fire, and corrosive substances; but these agents cannot be applied to a stone lodged in the body. Whence this expectation only seems to remain, that a medicine may be discovered capable of extracting the fixed air from the stone, yet of so mild a nature as not to injure greatly the parts containing the stone. As quick lime possesses these properties, the reason is ap-

parent why lithontriptic medicines of high repute have been prepared from this substance.

I shall next examine the lithontriptic medicine of Mrs. Stevens, which obtained the approbation of the British parliament, who gave her ten thousand pounds to publish the secret. The origin of this remedy was as follows: Mrs. Joanna Stephens, about the year 1720, began to administer egg-shells baked in an oven, and afterwards powdered, as a solvent of the stone. Some time after, she began to burn the egg-shells in an open fire, till they became perfectly white, and found them more efficacious in proportion to the length of time they were suffered to continue in the fire. The dose prescribed was a scruple three times a day, in a glass of white wine. But as these powders frequently occasioned excessive costiveness, she added a small quantity of soap, which she imagined might likewise assist the dissolution of the stone, and remedy the above complaint. She followed this method some years, which, as experience proved, expelled gravel from the kidneys, and sometimes even dissolved stones in the bladder. About the twelfth year of her practice, she began to administer calcined egg-shells in larger doses, frequently with the addition of half an ounce of Alicant soap, dissolved in some liquid; and as this medicine proved remarkably servicable to a man upwards of eighty years of age, who had long been afflicted with the stone, but during the use of this remedy voided many scales and fragments of stones, this case afforded a more striking instance of the lithontriptic virtue of her medicine, than any of the former ones; whence she afterwards increased the dose both of the powder and soap, and then met with still greater success. Hence it is apparent that the virtue of this medicine solely depends on egg-shell lime and soap.



The medicine having by this time grown into vast repute, to prevent a discovery of its composition, she mixed other ingredients with it, as garden-snails calcined and powdered, to one part of which she added six parts of egg-shell lime, and this mixture was kept in a stone jar, close stopped. She also added chamomile, fennel, burdock, parsley, or the roots of these plants when they could not be procured green; to these she also sometimes added mallows, marshmallows, &c. without finding the least difference in the effect of the remedy. She added also a small quantity of buckthorn plantain burnt to ashes, which she also mixed with the solution of soap. Indeed she owned that the above ingredients were only added to disguise the medicine.

These ingredients being therefore left out, the remedy was rendered more simple, by giving only two scruples, two scruples and a half, or even a drachm of egg-shell lime in any liquid three times a day, the patient drinking, after each dose, one third part of a decoction prepared from two ounces, two ounces and a half, or three ounces, of Alicant soap dissolved in a pint of water, or rather more, and sweetened with honey or sugar. Hence the proportion of the lime to the soap was as one to eight; by this means the body was generally neither too loose nor too costive; for as the powder would bind the body, the soap would render it laxative, and both impart a dissolvent virtue to the urine; the dose of each was increased or lessened, according to the different state of the bowels. However, if a purging came on, recourse was immediately had to opiates. Persons of a strong constitution were to use the extreme dose of each medicine; for the generality of people the middle dose is sufficient. But the best way is to begin with the smallest dose, when the stomach is weak, and the pains violent, and to render the medicine milder by calcining the powder

powder less, or by exposing it longer to the open air ; for every body knows that the fiery quality of all kinds of lime is lessened by these means. The lowest dose is also sufficient for very weak and old persons, as stones formed in old people are easy of dissolution. But young persons ought to take as large doses, as the stomach can bear ; for Dr. Hartley affirms, that from repeated experiments he is certain these medicines act less quickly in young habits, and that he never knew an instance of any constitution being injured from the increased dose of these medicines, or their long continued use. Whence his general rule was to administer to every one as large a quantity as the stomach could bear ; for the larger the quantity taken, the more quickly does the stone putrify and dissolve, and the different circles become more soft, which, when the medicine has been regularly taken some time, are generally voided with the urine.

For Dr. Hartley observed in himself, when afflicted with the stone, that the urine is changed by these medicines, and becomes more volatile, alcalious, smells like stale, putrid urine, and effervesces with oil of vitriol, oil of sulphur per campanam, spirit of nitre, spirit of sea salt, vinegar, and lemon juice, as is generally the case when these medicines are taken any length of time. Moreover experiments demonstrate, that human stones steeped in the urine of a person under a course of lithontriptic remedies, decrease in weight, but when digested an equal length of time in natural urine, acquire a greater degree of weight.

Whence he concludes that urine, from a plentiful use of quick lime and soap, is impregnated with a power of dissolving the stone, though at the same time it becomes alcalious and putrescent. But as physicians in diseases, from the appearance of the urine form a judgment of the state of the blood, from which that fluid



fluid has been secreted, many eminent gentlemen of the faculty have apprehended that the putrescency, and alkaline acrimony might corrupt the healthy fluids of such persons as took Mrs. Stephens's medicines. Mead inveighs bitterly against them, and blames some of the faculty, "for having acted a part much below their character, in suffering themselves to be imposed on, and encouraging the legislature to purchase an old woman's medicine at an exorbitant price." For he apprehended, from the highly caustic quality of this remedy, "that it might prove serviceable for the expulsion of gravel, but could never dissolve hard stones; and that a long continued use thereof was by no means free from great danger." Nevertheless, he acknowledges, with his usual candour, that lime-water alone has done infinite service when prepared from the shells of fish calcined, which in his opinion is different from common quick lime; and the experiments of Whytt demonstrate that shell lime water possesses greater lithontriptic virtues than that which is made from stone lime. The quick lime used by the builders in Holland is prepared from all kinds of shell-fish, and of this lime their lime water is made. If this lime is cast into urine newly voided, a considerable ebullition and heat are immediately produced, and an extremely acrid volatile vapour affects the nostrils, like a flash of lightning. Indeed Boerhaave says, "All these phenomena hold more true with respect to stone than shell lime;" which last, however, he made use of in his chemical experiments; at least it is apparent that calcined shells afford a real and efficacious quick lime. Whence the ill consequence, apprehended from Mrs. Stephens's medicine, is equally to be feared from quick lime, and lime water, on which the chief efficacy of her lithontriptic seems to depend, as will be observed hereafter.

Huxham allows the lithontriptic virtue of Mrs. Stephens's medicines ; but from the alcalious quality imparted to the urine, by a plentiful use thereof, questions whether the blood and humours may not be likewise affected in the same manner, which he justly thinks a dangerous circumstance in tender constitutions. As he had known a gentleman, who having been tortured with the stone several years, had taken soap-lees for several successive weeks, which caused a putrid scurvy ; of which, indeed, he recovered, but at the expiration of a few weeks died of a confirmed hectic, and a complication of disorders. But his death cannot fairly be ascribed to this remedy alone ; though it certainly was imprudent to administer it when the patient laboured under a complication of disorders, was consumptive, and besides of a very tender, weakly constitution.

Whether a long continued use of these medicines would prove as dangerous to a person troubled with the stone, and perfectly healthy otherways, may justly be doubted. For it is certain that many have taken these medicines a long time, without suffering any remarkable injury in their health. They are nauseous, and every stomach cannot bear a continued use of them ; though many, in hopes of relief, have persisted in their use with great resolution : and though the urine is rendered acrimonious, alcalious, and causes an effervescence with acids, it does not follow that the blood and juices are affected in the same manner by them. For the urine contains a much greater proportion of salts, and more acrid ones too, than are observed in the blood or serum ; which upon the affusion of lime-water, instantly emit a very acrid, subtle vapour. Now lime-water mixed with the blood, heightens its colour, but causes hardly any other change, according to Schwencke, who takes no notice that any acrid vapour was produced from the  
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mixture. As the more acrimonious salts are naturally voided with the urine, it being thus rendered more acrid than common, will flow over whatever stones may be lodged in the kidneys, and will act with greater force on such stones as may be contained in the bladder ; so that the external coats being macerated in this lixivium, will be softened, separated from those beneath them, and at length be voided with the urine : whence the bulk of the stone must daily be diminished, and at last the nucleus be expelled. Morand, an excellent judge of this matter, who was commissioned by the Royal Academy of Surgery at Paris, to scrutinize the effects and utility of Mrs. Stephens's medicines, attests, that many had taken them, a great length of time, without the least injury to their health ; and that some had manifestly received great relief from them, indeed such vast benefit that they thought themselves perfectly cured of the stone. It does not, however, appear, from his observations, that these medicines effected an absolute dissolution of the stone, though some patients voided fragments of stones with their urine. As persons afflicted with the stone are frequently incapable of holding their water, fragments of the stone were not observed to be voided till this complaint was in great measure removed, and thence the urine, impregnated with the lithontriptic virtues of the medicine, rendered capable of acting a considerable time upon the stone lodged in the bladder. Hard stones, he asserts, which when sawed through may be polished like marble or agate, were no ways changed or eroded by Mrs. Stephens's medicines, which, however, acted on softer stones, especially in aged persons ; but least of all in very young people. But as it is almost impossible to ascertain the degree of hardness of a stone contained in the human bladder, Morand advises all grown persons to make a trial of Mrs. Stephens's medicines, before they submit to the operation of lithotomy, which though

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greatly



greatly improved by modern surgeons, is by no means free from danger; and may be performed with equal safety after a trial has been made of Mrs. Stephens's medicines.

But he also observes, that they are by no means proper when there is an ulcer in the urinary passages, of which purulent urine is a certain sign, because these medicines increase the pains: yet a man aged thirty-four, afflicted with the stone, and an ulcer in his bladder, took Mrs. Stephens's medicines for three months; his pains were considerably increased, and he died about six weeks after he had left off taking them. Upon opening the body, it evidently appeared that the medicines had acted upon the stone, and there was reason to believe that the stone would have been intirely dissolved, provided the patient could have persisted longer in their use. Several other cases are also related in the memoirs of the Royal Academy of Sciences at Paris, which demonstrate that Mrs. Stephens's medicines act upon the stone in the bladder, and diminish its bulk; and that thin scales separated from the whole surface thereof, have been voided with the urine, as has been manifest upon the extraction of the stone by lithotomy, or on opening the body after the patient's death. But as these medicines act slowly, they must be persisted in a long time. Other instances have also demonstrated, that a long continued use of these medicines has remarkably relieved the different symptoms of the stone, even where, after the operation, there has not been the least appearance that they had acted on the stone, or lessened its size. Thus a man had taken Mrs. Stephens's medicines six months, and found great relief from their use: his pains left him, he could walk, ride on horseback, or in a coach, and could use any exercise without inconvenience for a whole year. At length he began to perceive an heat in his bladder, attended with

with a strangury, and an incontinence of urine. These symptoms were relieved at first by bleeding, and cooling medicines, but soon returned again. At last the patient resolutely submitted to the operation of lithotomy, as the only means of a cure, and a stone was extracted which weighed an ounce and a quarter, hard, compact, and of a rusty colour, which did not appear to have been at all acted on by Mrs. Stephens's medicines; yet, during their use, the urine had constantly deposited a large quantity of white sediment. The patient, after he had left off the medicines, used to void very fine reddish sand, resembling the extracted stone: he recovered the operation, and lived many years afterwards, in perfect health. Another person took the above medicines three years, at first every day, then at intervals, whenever he was in pain, and always found relief from them; but never was affected in his health, from so long an use of them; except that he rather grew more corpulent.

Hence it may be concluded, with justice, that Mrs. Stephens's medicines may be taken without hurting the constitution; that the bladder is not injured by the urine, rendered more acrimonious thereby; and that lithotomy may be safely and successfully had recourse to, after a long continued use of them; a circumstance of great moment. For although they do not appear to act upon hard stones, yet they exceedingly relieve the symptoms, and even for a great length of time; whence it seems as if lithotomy may safely be deferred, as long as the patient continues free from his complaints. Moreover, the candid observations of Hartley confirm the action of these medicines on the stone; who, in his dissertation on Mrs. Stephens's lithontriptic, gives the figures of several stones eroded thereby, and relates several cases, where, upon searching the patient, stones have been felt in the bladder, and during the use of these medi-

cines many stony scales have been voided with the urine, and at length the very nucleus of the stone itself, the symptoms entirely ceasing: in some no stone has been felt, though the bladder has been searched at three different times, after the evacuation of the above substances.

He owns however, that upon searching two persons, who had voided many fragments of stone, and one of whom imagined, after a sudden, but not painful suppression of urine, he had voided the nucleus of a stone, that contrary to expectation, a stone was felt in the bladder: yet one of these patients, during two years and an half, the other almost three years after he wrote the above, continued free from every symptom of the stone, nor felt the least inconvenience from any motion of the body whatever, even from being jolted in a carriage over the stones, an exercise that commonly much exasperates the pains this disorder.

As Mrs. Stephens's medicines contain a large quantity of calcarious earth, a doubt has been raised, whether the thin scales voided during their use, supposed to be separated from the stone, were not calcarious particles that had slightly accreted to the stone, and were thence easily broken off its surface; and therefore the size of the stone rather enlarged than lessened, by the use of these medicines; or at least the diminution of the stone a matter of uncertainty, from the above circumstance. The ingenious experiments of Macbride prove that even the most limpid lime water contains a calcarious earth, which instantly subsides, as soon as it has regained the fixed air, of which it was deprived by fire. Whence when these medicines set at liberty the fixed air contained in the human calculus, and attract it themselves, a calcarious earth is regenerated, from the same cause as renders the stone friable. Yet



Yet it does not follow, that the scales voided with the urine consist only of calcarious earth. De Haen, in his practice of physic, mentions a burgher of Cremenitz, who often voided with his urine, "a great quantity of white, glutinous matter, that after standing a while turned into white, brittle gravel," yet this man had never taken any thing in the least resembling Mrs. Stephens's medicines.

Besides, such calcarious scales alone are not voided after the use of these medicines. For instance, a person who, when a boy, had undergone the operation of lithotomy, being attacked with a return of his disorder, was twice examined, at different times, by an eminent surgeon, who, upon the introduction of a finger into the fundament, both times plainly felt a stone in the bladder, the size of an egg. Having taken these medicines, he soon voided a large quantity of brownish, rotten gravel, and many white scales. This discharge gradually ceasing, the cases of the stone were voided, to use the expression, inasmuch as the fragments consisted of several different scales laid over each other, many of which were irregularly shaped, externally white, but when rubbed seemed brown within side. At last the nucleus itself was discharged in pieces, brittle and porous, the symptoms then entirely going off. The patient being now examined a third time by the same surgeon, in the same manner, no stone at all could be felt. It is not probable that all the above substances voided by this patient were mere calcarious earth, beyond a doubt they partly consisted of the eroded substance of the stone.

This candid author owns, "that the lime contained in the medicines is deposited in the urinary passages:" for as the urine, impregnated with these remedies, is commonly turbid and whitish, and also quickly deposits a white, heavy sediment, he, in  
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concert with Hales, investigated the nature of this sediment, and of the fragments voided with the urine, during the use of Mrs. Stephens's lithontriptic. By way of experiment, he filled the bowl of a tobacco-pipe with bits of a real human stone; a second he filled with the fragments voided by a patient during the use of these medicines; a third he filled with the dried sediment of the urine of another patient. He placed the pipes upon a fire. The two first substances nearly evaporated; but out of twelve grains of the dried sediment, seven grains were left in the pipe. Whence it appears, that this terrene sediment is not of the same nature as the human stone; but that the fragments, voided with the urine during the use of Mrs. Stephens's medicine, and the human stone, are both of the same nature.

Stack also, from his own experiments, which merit repeated reading, concludes, "that the calcarious matter passed unchanged into the urine, as he has observed in the sediment of different urines." An human stone digested in a calcarious menstruum, first loses its nebulous coat, as he calls it, because examined with a microscope it has such an appearance; the stone is next covered with a whitish, hard, calcarious substance; then a thin scale peels off, the internal surface of which is porous; beneath this is placed another thicker coat, perforated with wider holes; and the same takes place in all the succeeding coats, quite to the nucleus; the innermost coat having the largest holes. These experiments perfectly coincide with those of Macbride. The lime contained in lime-water becomes visible when it has attracted the fixed air from other bodies; and the experiments of Hales prove that a great quantity of such air is contained in the human stone. Stack demonstrates that this air is confined in a certain glutinous substance, resembling mucilage of quince-seeds; which he has observed

observed forms one of the component parts of both flints, and human stones ; when a human stone is digested with lime water, the lime, now saturated with fixed air, subsides, and the different layers of the stone, quite down to the very nucleus, become porous. Does not the loss of the fixed air produce this effect ? At least this supposition is highly probable. And as this air continuing entangled with the glutinous substance, may in its exit take part thereof away with it, and, through the apposition thereof to the sides, render the holes of the outermost coats narrower than the others, is not this the cause why the holes are widest in the coats nearest to the nucleus of the stone ? The above, at present, are mere conjectures ; but the result of experiments, not the effect of a luxuriant fancy. If the Roman senate judged the citizen worthy of applause, who had resolution enough not to despair of the republic in the most desperate situation, those great men certainly deserve commendation also, who venture to entertain expectations of solving this most difficult problem in the science of physic, viz. the dissolution of the stone in the bladder.

It cannot be denied, that the profession has already made some progress in the discovery of medicines called lithontriptics, because they diminish the bulk of stones, and thereby facilitate their expulsion. Yet, it must be confessed, the most celebrated have often proved ineffectual ; for some stones are so extremely hard, as to elude the action of all known lithontriptics : but others, which less strongly cohere together, yield to the efficacy of these medicines. Moreover, it is apparent, from a variety of instances, that the most excruciating tortures of the stone have not only been alleviated, but even totally removed, for several months, nay years, though the stone was not dissolved, but still remained in the bladder. What a prodigious



prodigious happiness is even this last circumstance to the miserable sufferer !

But though it appears from unquestionable authority, that Mrs. Stephens's medicines have been of great service, yet it frequently happens, that patients cannot persist in their use a sufficient length of time, as they often occasion a violent and insuperable nausea, whence the most eminent of the profession have done their utmost to surmount this inconvenience.

Indeed, it is apparent, from the preceding account of Mrs. Stephens's medicines, that many ingredients were added that only increased the bulk, not the efficacy of the medicine. For when Mrs. Stephens disclosed the composition of her medicines, she owned that the additional ingredients might be safely omitted, as they had only been used to disguise the medicine. Whence Hartley retained only the egg-shell lime and soap, and thus much lessened the dose of these medicines.

However, the middling dose, for an adult (for they were to be taken in different doses, according to the strength and age of the patient) sufficient for one day, still amounted to two ounces and a half of Alicant soap, and two drachms and a half, troy weight, of calcined egg-shells, which powder being extremely nauseous, and the quantity of soap large, the medicines, even thus reformed, can be taken but by few, any length of time, without bringing on an insuperable nausea.

Hence Whytt has attempted a farther emendation of them. From the experiments of Hales thereon, he judged that their efficacy chiefly depended upon the quick lime ; and that, for this reason, lime-water would answer as well as the above nauseous medicines.

cines. The circumstance of Mrs. Stephens's having at first used calcined egg-shells alone, and of her having added the soap afterwards to remedy the costiveness usually brought on by the powders, confirmed him in his opinion. And as from the experiments of Hales, the other ingredients of which soap is composed, (viz.) oil and the alkaline salt called potash, conduce not in the least towards the dissolution of the stone; its whole virtue must depend upon the quick lime, or lime-water used in making the soap. Wherefore leaving out the soap and egg-shell lime, he determined to try the effects of lime water by itself: for thus he imagined the lithontriptic virtues of a greater quantity of lime might, with safety and less inconvenience, be conveyed into the blood. For of the powder (already half flaked, and consequently greatly weakened by being exposed sixty days to the open air) only a few scruples are taken in a day, and if swallowed without enough liquid, occasion great heat and uneasiness in the stomach; for every body knows that a fiery heat is generated the instant water is poured on lime; and if it is sufficiently diluted it can have little other effect than weak lime-water, which is found by experience to dissolve stones out of the bladder. Is it not therefore reasonable to expect, that when taken in large quantities, and but little weakened by drinking of other liquors, the urine likewise may be so far impregnated with its virtues, as to acquire a power of dissolving the stone.

But as reasoning *a priori*, unsupported by experience, is not sufficient to ascertain the virtues of any medicine; Whytt embraced the first opportunity that offered to make a trial of lime-water, the effects of which will best appear from the following history.

Mr. David Millar, about sixty years of age, had been for many years distressed by stones passing from  
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the kidneys to the bladder. Sometimes he had severe fits of pain once or twice in a year, and sometimes but once in two or three years; and these of two, three, four, and even of eight and fourteen days continuance: but always in a few days after these fits, he voided one or more stones, till at length, having been thus afflicted thirty-six years, after a very severe fit, that lasted two days, a stone arrived in the bladder; but though he used his ordinary means of riding, walking quick, jumping, and drinking plentifully of proper liquors to make it pass, yet all his endeavours were in vain. For half a year after this, he was troubled with frequent obstructions in making water though without any great stimulating pain, except in voiding the two or three last drops. He soon found the stone increase and become heavier in the bladder, and upon riding a mile or two his urine was always mixed with blood; besides he lost all power of retaining his urine, so that it went from him every eight or ten minutes, which was accompanied with excruciating pain, yet sometimes with intervals of ease for a day or two, after sweating and keeping warm.

At first he drank milk and water; but in the eleventh month after the last nephritic fit, he began to take soap, first to the quantity of half an ounce every day, which he gradually increased, till in the beginning of the fifteenth month he took an ounce and a half in a day; but without finding any relief; his pain, bloody urine, and incontinence of urine, still continuing as before.

Dr. Whytt therefore now advised him to drink large quantities of lime-water with the soap, beginning with a pint, and gradually increasing the quantity to three pints a day, and to drink no more of any other liquor than was absolutely necessary to quench his



his thirst, that the urine might be more fully impregnated with the lithontriptic properties of the lime.

Within four or five days, he recovered in great measure the power of holding his water, and from this time had less pain, and less bloody urine, upon using exercise, than before; so that about the middle of the seventeenth month, from his first attack, though he walked fast above six miles, yet he held his water for nine or ten hours together, and voided it with little pain, and unmixed with blood.

The second evening after, when going to bed, and trying to make water, he found a stone entering the beginning of the urethra, and obstructing the passage. He slept little, and often attempted to make water in vain; but the next morning he voided a smooth stone, the size of a common bean, of a whitish colour: whereas all those he passed formerly were of a brown colour and rugged. It appeared plainly to be part of a larger stone, and though he was greatly relieved, from voiding this stone, yet he felt still a stone in his bladder, and his urine deposited a large quantity of white sediment with some brownish flakes. During the whole eighteenth month he was much indisposed, the stone frequently entering the beginning of the urethra and afterwards rolling back into the bladder; however, his pains were not very violent, and he could hold his urine half a day together, and felt no pain when he voided it. The patient encouraged at this success, persisted in the use of the soap and lime-water, which last he frequently drank at his meals instead of other liquors, and fancied that his urine tasted of it. At length, about the beginning of the nineteenth month, in the evening, he perceived that a stone had got into the beginning of the urethra, which almost wholly obstructed his urine. However, next morning, after a sound sleep,

it came away. It was larger than the stone voided before, and seemed evidently a fragment of the same stone. For some days after voiding this stone the urethra was very tender, and a little painful, which occasioned his making water more frequently than usual; but this soon went off, and ever since he has been perfectly free from pain, and all symptoms of the stone or gravel, which happiness he chiefly ascribes to the lime-water, as he had no relief from a constant use of soap. Two years after the expulsion of the last stone, the patient sent Dr. Whytt an attestation of the truth of the above fact; wherein he affirmed that he continued free from all nephritic complaints.

Whytt afterwards relates many experiments, which demonstrate that lime-water prepared from sea-shells, acts on animal stones immersed therein, in such a manner that their outsides change white, soft, and friable; and when the external coat falls off, the lime-water acts in the same manner upon the inner layers, and thus diminishes the bulk of a stone. Lime-water is prepared in the following manner: a gallon of boiling water is poured upon a pound of fresh made shell quick lime, and after the mixture has stood five or six hours, the water is filtered through paper, and kept for use in a bottle with a glass stopper. Several pints may be drank in a day with safety, even by young persons. He likewise observed, that lime-water, when mixed with urine, prevented the accretion of the elementary principles of the stone.

Dr. Whytt has also made various experiments on the substances commonly used in diet, in order to determine whether they do or do not diminish the lithontriptic virtue of lime-water; in consequence whereof he advises, that all fermented liquors, acid fruits, such as gooseberries, strawberries, cherries, apples,

ples, pears, and the like, and honey ought not to be used by those who take lime-water as a lithontriptic.

Lime-water, when drank, does not render the urine alkalious, as Mrs. Stephens's medicines do; which phenomenon therefore must happen from the great quantity of alkaline salt contained in soap. Now Hales has observed that pot-ash does not dissolve the stone: but soap acts upon the stone; its lithontriptic virtue must therefore principally depend upon the lime that enters into its composition. Possibly soap acts also by dissolving the glutinous substance discovered by Stack in flints and animal stones, as has already been mentioned. Whence an ounce of soap is directed every day with a plentiful use of lime-water, beginning at first with a small quantity, and gradually increasing the dose. Where the stomach cannot easily bear the soap, the same effect may be procured from shell lime-water alone drank plentifully and long persisted in, without intermission. If a patient finds relief from drinking lime-water, Whytt would have the use thereof continued for several months, and even years, provided the stone is large. I have observed in my commentaries on the aphorisms of Boerhaave, that lime-water is excellent to cleanse the blood of a muriatic acrimony: but though I have there advised a sparing use thereof, apprehensive that for the reasons there recited, some bad consequences might ensue a plentiful use thereof, I have since found from repeated experience that the human body bears without injury large quantities of lime-water, though constantly taken a great while, and that it affords prodigious relief in the stone. The case of the shoemaker related by De Haen is remarkable. The poor fellow had been troubled with the stone seven years, at length he began with drinking only a few ounces of lime-water, mixed with an equal quantity of milk, gradually increasing the quantity till he took two quarts

of



of lime-water with the same quantity of milk, and an ounce of Alicant soap, every day, so that he took seventeen pounds of soap, and above one hundred and eighty seven gallons of lime-water, besides milk, in the space of seven months. About the third month his pains entirely left him, and he could hold his water, and though he left off taking the medicines constantly, and being discharged from the hospital, fed heartily on salted meats and high seasoned food, he still continued free from his complaints. Nevertheless, upon searching the bladder, a stone was plainly felt, and his urine was mucous. Having been bled, on account of a phlethora, his blood exhibited every good appearance, a conclusive proof that lime-water may be taken as above directed without the least apprehension of danger. I myself advised an old officer to drink lime-water mixed with milk, without the addition of soap, who was thereby entirely relieved of the complaints he suffered from a stone in his bladder. It is certainly a vast matter, to be able to alleviate the symptoms, in cases where lithotomy cannot take place with a probability of success.

Patients who loath milk may drink lime-water by itself; but in all probability the lithontriptic virtues of lime-water are strongest when it is drank unmixed with milk.

Macbride attributes the lithontriptic virtue of lime-water principally, to the power whereby the lime contained therein, attracts the fixed air that constitutes so considerable a part of the stone; his experiments demonstrate that the addition of a third part of milk weakens the lithontriptic quality of lime-water; the milk saturating part of the contained lime with its fixed air, and precipitating it, whence the lime water is rendered inert, and less capable of destroying the cohesion of the particles of the stone. Moreover Dr. Alston has observed, that

that most of the ingredients usually added to lime-water, more or less weaken its lithontriptic virtue; whence he advises it to be drank alone without any mixture.

He is also of opinion, that the real cause why lime-water sometimes produces no remarkable good effect in dissolving the stone in the bladder is, because in the first passages it meets with the vapor of the fermenting aliment, which, as has already been mentioned, precipitates the lime. Nay, should the lime-water pass into the bladder, possessed of its whole lithontriptic power, it would there meet with the urine, which fluid also contains fixed air, by which part at least of the lime-water would be saturated, and thus its lithontriptic virtue weakened. To this cause also he attributes the earthy matter that generally subsides from the urine of persons who drink lime-water, for he supposes it precipitated from the lime-water.

The expectations formed from lithontriptics are, that the urine impregnated with their virtues, may act upon the stone lodged in the bladder, which is steeped in such medicated urine; whence the patient is directed to hold his water as long as possible.

From the above observations it is apparent, that by the use of these remedies patients often receive vast relief, and also that there is the greatest reason to expect, that the stone will be diminished in its bulk by persevering therein.

However, as all lithontriptic remedies, inwardly taken, lose some part of their virtues, both in the first passages, and during their circulation with the fluids of the body, before they can arrive at the bladder with the urine, and act upon the stone; physicians have justly thought of injecting such lithontriptic liquids into the bladder through the urethra, as it was reasonable

sonable to suppose might be borne without injury to the structure of the bladder.

Thus Whytt has proposed, that during the internal use of the above lithontriptics, five or six ounces of tepid lime-water should be injected into the bladder with a syringe every day, immediately after the patient has made water, and be retained as long as the patient possibly can; and thinks this injection would succeed still better if thrown up several times a day: now as the repeated introduction of a common catheter must prove very troublesome and painful, if a flexible catheter was kept constantly in the bladder, this inconvenience would be avoided, and the injection might be repeated as often as might be thought proper.

But sometimes the bladder is so tender that it cannot bear lime-water, though rendered more lenient by being mixed with new milk; as De Haen has remarked in the shoemaker already mentioned, who though he resolutely persisted in the internal use of lime-water and soap, could not possibly bear an injection of lime-water and milk, which was attempted to be injected into his bladder, with an instrument contrived for that purpose, "however cautiously, or in whatever quantity administered." Whence the opinion of Whytt seems perfectly just, that the patient ought to drink lime-water some weeks, to diminish his pains, previous to its being used as an injection: for by this means the inside of the bladder will become less tender, and more easily bear and retain the injection longer, whereby it may more effectually erode the surface of the stone in the bladder.

Nevertheless as the stomach and bowels can without injury easily bear lime-water, which may also be dropped into the eye without any remarkable inconvenience, and is used by surgeons to foment old  
ulcers



ulcers without giving pain, lime-water does not seem acrimonious enough to injure the human bladder. However, should the internal coat of the bladder happen to be so extremely tender as to be much irritated by an injection of lime-water, a drachm of starch, or the fourth part of the yolk of a new-laid egg may be mixed with half a pint of lime water ; the starch, when dissolved in the lime-water, should be just brought to boil over the fire, and kept constantly stirring, till perfectly smooth : by this means the injection will occasion far less uneasiness, though its lithontriptic power is no ways weakened. The mucilages of linseed and gum Arabic have been tried for the same purpose, but they both diminish the efficacy of lime-water when mixed therewith.

As these injections, to prove beneficial, must be frequently repeated, it is dangerous to make this attempt by passing a common catheter into the bladder, for frequently patients afflicted with the stone complain of exquisite pain, though the instrument be passed by a very dexterous and experienced surgeon : nay many, after having been once searched for the stone, can upon no account suffer a second introduction of the instrument, even though a considerable time has elapsed. To say the truth, as the injection requires to be thrown up at least once or twice every day, few males either can or will comply with their use. For which reason another method has been invented, by means of which lime-water may be thrown up the urethra forcibly enough to overcome the sphincter muscle of the bladder, without the least injury to the parts, whereby the repeated passing of a catheter into the bladder is avoided. Mr. William Butter has contrived an instrument for this purpose, by means of which the patient may throw up the injection himself without any other assistance. The contrivance is as follows : the lime-water is tied up

in a hog's bladder, the neck whereof, by means of two pipes, the second of which has a moveable cock, is nicely fitted, to another ivory pipe, which is introduced a good way up the urethra, lest the lime-water should regurgitate, and the bladder being pressed, the contained liquor passes through the pipes with a considerable degree of force, which may be moderated at will. The bladder is fixed on a hollow piece of wood, shaped externally like a pair of bellows, the upper side of which being pressed downwards, the bladder is compressed, and the contained liquor forced out. As it is far easier to improve than invent, in all probability Butter's instrument might be rendered more simple. The following precautions must be observed in using this instrument: The patient ought to make water immediately before the operation; he should lie in bed upon his back, with his legs drawn up to his body, and his thighs asunder; he should breathe in his usual way, and be sure not to give any resistance to the injection, when he feels it entering the bladder, and to restrain any attempt to make urine, although he should at that time have a small inclination to it. The lime-water should be blood-warm: the bladder fixed to the pipe must be strongly and firmly tied, or it will be apt to burst, or to allow the lime-water to escape. The pipe should be dipped in oil, previous to its introduction. After the pipe is introduced, the patient must compress his yard very firmly with his hand, else the liquor, instead of making its way into the bladder, will return by the urethra towards the point of the yard. No more liquor should be put into the bag than is intended to be thrown into the bladder. In females the pipe may be passed quite into the bladder, with great ease, and without giving any pain; and as women may easily be taught to make the injections themselves, the stone in females must in time be so certainly dissolved, that for the future it will only be necessary for

for them to have recourse to lithotomy in very rare cases. And as the severe stimulating pains, are owing to the roughness of the surface of the stone, shell-lime water injected as above, two or three times a day, would not fail, in a very short time, to give certain relief from these pains, by converting its surface into a soft, chalky substance ; and dissolving its sharp points. Several cases are described that confirm the efficacy of this method.\*

Hales has made several other experiments concerning the dissolution of the stone ; particularly he infused human stones in acid and alkaline liquors, mixed at the very time of their effervescing, in hopes that the fixed air, latent in the stone in such great plenty, might be separated, and rendered elastic, from the sudden concussions of the effervescing liquor, and thereby a dissolution of the united, elementary particles of the stone be effected. The result of this experiment often repeated was, that some stones emitted a great many air-bubbles, and also became brittle ; but the experiment did not produce the same effect on hard human stones : nor did the liquor produced by the mixture of the acid with an alkali, act at all upon human stones steeped therein. Indeed Hales owns, that these experiments did not in the least incite him to make a trial thereof on patients ; as the application of effervescing liquors to the stone, ought to be frequently repeated, to produce any considerable effect, and the acid and alkaline liquors should be injected separately, that the effervescence might be caused in the bladder itself : now both these liquors are too acrid to be suffered in the human bladder without injury.

From the foregoing observations it appears that shell-lime water may be safely used internally, either

\* A method for the cure of the stone chiefly by injections, p 61.



by itself or with Alicant soap, and that it has proved serviceable to numbers, nay has sometimes entirely taken off the different symptoms, though the stone itself still continued in the bladder, in appearance no ways altered by the medicine. Moreover, many of the above-recited cases demonstrate that lime-water really possesses a lithontriptic power, especially if the stone is not very compact and hard ; which effect it must exert in a greater degree, provided it be injected properly into the bladder ; for then it would be digested in its full strength, several hours, with the stone, assisted by the warmth of the body, and thus the most sanguine expectations might be formed of diminishing the bulk of the stone, at least of rendering it so friable that by degrees its whole substance might be voided with the urine, and the patient thus radically cured. Besides it is highly probable, that a constant use of lime-water, prevents the separation of fresh calculous elements from the urine; for the experiments of Whytt demonstrate that the separation of such particles from the urine, out of the body, is not only prevented by the addition of lime-water, but that in urine suffered to stand in a chamber-pot forty eight hours, the stony concretion formed round the sides and bottom, was presently dissolved by pouring lime-water upon it ; and though the chamber-pot was then suffered to stand unmoved thirty hours longer, no more stony concretions adhered to its bottom or sides.

Now if no fresh stony particles are added to the stone contained in the bladder, its surface must, by degrees, be abraded by the urine and the pressure of the bladder, when the urine is forced out by the contraction thereof, as well as from its rotation in the cavity of the bladder, when full of urine, and from walking, or any other cause, the patient moves his body. 'Tis true indeed, that the internal surface of the bladder is also abraded by the stone, but the membranes continue

tinue whole, though they are sometimes greatly thickened in cases of this kind. Now the bladder is part of a living body, in which the abraded parts are constantly restored by nutrition: but the stone is an inanimate substance, that is incapable of receiving nourishment; hence unless from the apposition of fresh calculous particles, its bulk must consequently be lessened by degrees. But the prodigious relief that persons afflicted with the stone receive from a constant use of lime-water, as I know by experience myself, and as is attested by authors of the best credit, sufficiently authorizes the administration of this remedy, even though it had no lithontriptic virtue. In all probability there are many remedies, which relieve the symptoms of this disorder, though they do not dissolve the stone.

Linnaeus, in the preface to his oration, on the increase of the habitable earth, spoken at Upsal, in 1743, makes mention of *Uva Ursi*, a shrub very common in Sweden. The use of this plant has since been strongly recommended by the Montpellier physicians. Half a drachm of the powdered leaves are to be taken in chicken broth, ten successive days, as a lithontriptic. These leaves are highly astringent; whence in Sweden they are in high reputation for the purpose of tanning leather. It is well known that the hides of animals, to render them fit for our various uses, require to be macerated a long while, whereby they become so soft and flaccid, that they can scarcely be touched without being torn: hence tanners always use astringent substances to restore their lost firmness. Different plants are used for this intention in different countries, particularly such as cost but little. Wherefore *Uva Ursi*, being a strong astringent, and common in Sweden, is there used for the purpose of tanning leather.

As this shrub grows plentifully on the mountains of Austria and Styria, wholly buried in snow during several months of the year, I easily procured a quantity of its leaves, the powder of which, by my direction, was administered even in a larger dose, to patients troubled with the stone, frequently with such extraordinary benefit that the patient has imagined himself perfectly cured, though upon searching the bladder a stone has been plainly felt, as De Haen assures us. Some were soon relieved, others were longer before they obtained ease from their pains, which when intolerable were quieted by opiates, during the use of the Uva Ursi. But that the relief did not proceed from the opiates only, is evident from this circumstance: opiates were not wanted afterwards, though the stone still remained in the bladder. Besides, the urine which smelt very offensively, and was highly alkaline previous to the use of Uva Ursi, soon became like healthy, natural urine; the purulent discharge, and heavy viscid mucus, frequently voided with the urine by persons troubled with the stone, stopped; the stone however still continuing in the bladder. Nor was this cessation of the symptoms of short continuance only, but lasted during several months; and it has been remarked in some who left off taking the Uva Ursi, that the different symptoms returned; which however were quickly relieved again by a repeated use of the medicine. Repeated experience has convinced me, that it is of remarkable service in ulcerations of the urinary passages, where there is not the least reason to suspect the disorder caused by a stone; whence this medicine deserves to be used in practice, though we know nothing certain concerning its lithontriptic virtues.

Helmont recommends the juice of the birch-tree which flows from its wounded branches in spring, as an useful medicine in the stone; he prefers the juice of the branches as more pure and rich than that which exsudes from the trunk, which is almost entirely aqueous



aqueous if the trunk is wounded near the root. He particularly expected great things from this remedy, both as a preventative of the stone, and to alleviate the excruciating symptoms of the disorder. Boyle affirms of this juice, that he has known many persons afflicted with the stone greatly relieved by it, particularly one of his cousins, who had, in vain, tried an incredible number of remedies. For his use Boyle procured a large quantity of this juice in the spring season, and kept it fit for use by covering its surface with fallad oil, to prevent the access of the air, or by fumigating the cask with burnt brimstone, to prevent its fermenting, whereby he procured him a longer alleviation of his tortures. But this juice does not appear to possess a lithontriptic power; for upon opening the body of this gentleman, who died of another distemper, a large stone was found in the bladder, which did not seem to have been acted on by the medicine, though taken in large quantities, and for a considerable time. In all probability, these remedies prevent the growth of the stone, at least, while they are taken; it is certain they relieve the symptoms, and render life more tolerable to the unhappy patient: now this is a matter of some consequence. Helmont remarks these two circumstances in the cure of the stone; viz. the prevention of its increase, and the destruction thereof when formed. A remedy is required capable of preventing the future increase of the stone, by rendering the urine medicinal, &c. but the schools have been solely intent on expelling the stone, and relaxing the urinary passages: therefore in the cure of the stone, a double intention is obvious; first, to remove the predisposing cause; secondly, to destroy the stone already formed." To effect either is a matter of great difficulty; for we learn from medical history, that some persons have had stones repeatedly formed in the bladder, and have been under a necessity of undergoing

dergoing the operation of lithotomy several times. Now to dissolve a stone already formed in the body, or to erode it in such a manner, that lessened in its size, or broken to pieces, it may be discharged with the urine, is a matter of equal difficulty. One menstruum is only hitherto discovered, that is able to dissolve human stones, viz. spirit of nitre : but this is so acrimonious, that if injected into the human bladder, it would entirely destroy its structure. If given inwardly, it will require to be very much diluted, in order to be borne without injury by the stomach and bowels ; but when diluted, its solvent virtue is destroyed, and before it can arrive at the bladder, from being mixed with the different fluids of the body, it in all probability will be rendered quite inert. Whence physicians in general, have no opinion of the lithontriptic virtues of spirit of nitre.

Pechlin relates, that a French empiric in Holland boasted of being in possession of a certain lithontriptic. He used to dissolve, before the eyes of the spectators, in a certain liquor, an human stone, which he instantly precipitated again with oil of tartar per deliquium, or some alkaline lixivium. The clear liquor seemed tolerably mild if tasted after the precipitation had been made : but he would not suffer any one to taste it, previous to the addition of the alkaline lixivium, pretending he was tied by oath not to reveal the secret. At last this nostrum was discovered, and found to be acrid : one of the medical students produced a small quantity of dulcified spirit of nitre, which dissolved a human stone with equal facility as the empiric's liquor, and upon the mixture of oil of taatar, the very same precipitation was caused, and as it likewise resembled the nostrum both in colour and smell, it was judged to be the very same, by the whole audience ; whereupon the impostor took his leave of the place. But even dulcified spirit of nitre, cannot  
be

be borne by the bladder, unless greatly diluted, and when mixed with a large quantity of water, must become inert ; which upon the same account must also happen, when it is given internally.

It is clear from the preceding observations, that no slight advantage has sometimes been reaped from quick lime and soap mixed together in different methods, or administered separately. Now soap contains a portion of alkaline salt, rendered more acrid by the addition of quick lime, together with a vegetable or animal oil. For soap is made in the following manner: an igneous. fixed, alkaline salt, prepared with quick lime, is dissolved in such a quantity of clear hot water, that the lye produced thereby will bear a new laid egg. This liquor is called capital soap lees ; a part whereof is diluted with a further quantity of water, till a new laid egg sinks to the bottom of this second lye. An equal quantity of oil is mixed with this second weaker lye, and the mixture is gently boiled, until the water wastes away, and the ingredients begin to unite together. Thrice the quantity of the oil, of capital soap lees is now added, and the whole is boiled together, till it becomes a solid, hard substance, called soap, which if too acrid, is rendered less so by the addition of more oil ; on the contrary, if the oil predominates, a little more capital soap lees is added.

From the composition of soap, it is apparent, that its lithontriptic virtue principally depends on the capital soap-lees, which contain an alkaline salt rendered more acrimonious by lime ; whence several ingenious men have tried numerous experiments to ascertain the degree of lithontriptic power this medicine possesses. Hartley relates several experiments made by Hales, with soap-lees, on two human stones, one of which was large and of a pale brown colour, the  
G
other



other of a dark brown, and very hard, which, when sawed through, glistened like polished marble. A part of the first stone was dissolved by being boiled half an hour in capital soap- lees : during the operation a vast number of air-bubbles issued from the stone, which circumstance he justly considers as a certain sign that the stone is very near breaking to pieces. And by infusion alone, a piece of the same stone dissolved, in a longer or shorter time, according to the degree of heat ; and even in consequence of a cold infusion, the stone was dissolved by capital soap- lees in three days. A piece of the other harder stone, boiled in the above lye a full hour, did not dissolve, but the external surface was rendered so soft as to resemble a kind of stiff mud ; and the internal parts became rotten and friable ; another bit of the same stone became rotten and friable, in consequence of having been infused in the same lixivium with a gentle heat, for seven days ; whence it appears that soap- lees wholly dissolved the stone of moderate hardness, and rendered the other brittle ; but a lye of fixed alkaline salt alone, though of the same specific gravity, and therefore equally saturated with alkaline salt, had no effect on pieces of the same stones steeped therein.

From the above experiments Hartley concludes,  
 “ that a lye prepared of quick-lime and fixed alkaline salt, is a most powerful dissolvent of the stone,  
 “ far beyond a lye of alkaline salt alone, and excelled  
 “ only by spirit of nitre.”

He relates several other experiments which demonstrate that the urine is medicated by this remedy, so that a small quantity suffices to prevent the apposition of fresh stony particles from the urine to the stone already formed, and if a larger quantity is taken, the urine will erode the stone, which is constantly steeped in it. Moreover it is proved that lime-water possesses a sufficient degree of lithontriptic virtue,

tue, which is increased in proportion to the strength of the lime, and the smaller quantity of water with which the lime is quenched. In preparing lime-water as a lithontriptic, a gallon of water is usually added to a pound of lime; for lime-water of this strength may safely be drank in large quantities, as is evident from the preceding observations.

But capital soap-lees are highly acrimonious, and from this liquor inspissated is prepared the potential caustic called *lapis infernalis* by surgeons; which applied to the skin presently produces a gangrenous eschar on the part, whence it is apparent that soap-lees can only be given in a very small dose, and mixed with a large quantity of some soft fluid.

Hartley judged that half an ounce of capital soap-lees might be taken in half a pint of new milk four times a day without injury. But he candidly owns, that a sufficient number of experiments had not been made to ascertain this fact with precision, and exhorts the profession to be strenuous in their endeavours to determine the matter. Meanwhile, in my opinion, it is the safest way to begin with a small dose; for in the beginning of such a cure the pains are increased, as Jurin experienced in his own case. I lately advised a person afflicted with the stone to take sixty drops of capital soap-lees every morning, in rather above three quarters of a pint of veal broth, and gradually to increase the dose of the lees in a like proportion of the broth. He has since acquainted me by letter, that when he had augmented the dose to 120 drops, his pains raged with greater violence, and he voided a large quantity of mucus with his urine. Jurin increased his dose by degrees, till at last he took every day an ounce and a half of capital soap-lees; but in like manner diluted in a liquid, which however was hardly mucilaginous. Nor does it appear that he

perceived any relief, till he had taken the soap-lees four months. Towards the fifth month he voided some stones; but was not perfectly cured at the expiration of seven months. Whence Whytt prefers lime-water, because it much sooner relieves the patient. Dr. Chittick administers a nostrum, which if taken several months, has frequently dissolved the stone; the patients send a mess of broth every day to him, wherein he mixes his nostrum, which from the ingenious experiments of Dr. Blackrie, evidently appears to be only capital soap-lees.

This remedy is vastly acrid and fiery, wherefore it cannot be taken inwardly, unless exceedingly diluted; hence it is probable, that when it arrives at the bladder, with the urine, it is rendered almost wholly inert; an objection that has, with reason, repeatedly been raised against the boasted virtues of other lithontriptics. However, beyond a doubt, alkaline salts rendered more acrimonious by the addition of quick lime, possess considerable solvent qualities, though diluted with a large quantity of water. In my commentaries on the aphorisms of Boerhaave, I have taken notice of a similar medicine, as highly efficacious in dissolving of gouty chalk-stones. It is composed of tartar calcined in an earthen vessel, with three times its weight of quick-lime. This saline mass is dissolved in clear water, and filtered, and then inspissated into a salt, which is afterwards again dissolved in such a quantity of water, that the solution when tasted, occasions no uneasy sensation on the tongue; yet this very weak solution dissolves gouty chalk-stones in a few days. Now if it be considered that the most eminent physicians acknowledge a great affinity between stones in the bladder and gouty chalk-stones, it will be evident that we ought not to despair of the action of similar remedies on the stone in the bladder, though exceedingly diluted.

Some



Some medicinal waters also dissolve human stones, if steeped therein ; yet the contents of such are diluted with a great quantity of pure water. Thus the Caroline baths, though they incrustate the pipes through which they are conveyed, and substances dipped in them with an hard stoney shell, yet remarkably lessen the bulk of human stones, if steeped therein ; as Springfield has observed in renal and other stones, steeped not only in the water of these baths, but also in the urine of persons who drank those waters ; while, on the other hand, human stones, when infused in the urine of persons who have not drank the above waters, are increased in size : but these waters take not the same effect on stones of the gall bladder. Hence it is apparent, that those who think the urine may be changed by medicines taken into the stomach, so as to soften and erode the surface of the stone in the bladder, and, thus by degrees diminish its size, or render a rough stone smooth, and thereby less injurious to the bladder, do not entertain ill-grounded expectations.

Hartley, from experiments, concludes, that even pure water is a lithontriptic : he says, “ that if a stream of pure water passed through the kidneys and bladder, a sufficient space of time every day, it would entirely dissolve whatever stones might be lodged in either part.”

But he would have the incrustating quality of healthy urine prevented by medicine, which otherwise, by a constant application of new stoney particles, would augment the size of the stone faster than the stream of the water could waste it. This effect, he is of opinion, may be obtained by the use of a lithontriptic composed of quick lime and soap. Whence this and other similar remedies act in a two-fold manner : first, by preventing the increase of the stone ; secondly, by imparting a medicinal quality to the  
urine,

urine, whereby it is enabled to act upon the stone; as he has proved by an experiment made on his own urine, which greatly lessened the bulk of an human stone steeped therein, at the time he was taking these medicines. The very accurate Stack, from his experiments, concluded, “ that urine which generates “ stones differs at different periods, so as at particular times to generate more, at others, fewer “ stoney particles; and that sometimes in a different “ state of the body, the urine may, on the contrary, acquire a lithontriptic quality.” The accounts of herdsmen, who affirm, that cattle housed during winter, and kept on hay, are afflicted with the stone, and are cured in the spring by being turned out to grass, confirmed him in his way of thinking. Moreover, he perceived in a smooth stone voided by the urinary passage, evident signs of corrosion on the inside of the outermost circle, that seemed to have been made at a time when the urine had acquired a lithontriptic property; to which fresh stony matter had afterwards accreted, when the urine was disposed to generate the stone.

Lobb took another method to impart a lithontriptic quality to the urine. But as the stone contains a great quantity of fixed air, he did not wish for a quick dissolution of it, though it could have been effected; afraid, lest from the elasticity suddenly restored to the inelastic air, an explosion and other mischiefs should ensue in the human body. Upon which account, he rather chose to effect the dissolution of the stone by substances friendly to the constitution, viz. aliments. He therefore endeavoured to ascertain by experiments, whether among the foods and sauces commonly used, there might not be some possessed of a lithontriptic property, when applied to human stones out of the body; if such were discovered, he was of opinion that those were to be eaten

eat in preference to other aliments, and all such were to be abstained from as did not act upon human stones out of the body; not because he imagined they were hurtful, but as they hindered the taking of more proper aliments, the stomach being incapable of containing more than a particular fixed quantity of solid and liquid food.

This great physician was perfectly sensible that aliments, when received into the human body, are divested of their own nature, and assume that of our bodies; nevertheless it is a certain fact, that some substances, while they as yet continue in the stomach, impart a flavour to the urine, as asparagus, turpentine, &c. whence, it is probable, that other qualities of liquid and solid aliments also may quickly arrive at the kidneys and bladder: although the sensible qualities of the urine do not appear to have undergone the least change. He made a great many experiments of this kind, and steeped human stones in decoctions, or infusions of the different vegetable substances that supply the table. Among the principal dissolvents of the stone, he reckons, “the juices of lemons and radishes, and the strong decocted juices of mulberries and strawberries, vinegar, the juices of elder berries, pears, and grapes, honey and water, asparagus juice, parsley, milk, chocolate, smallage, cucumbers, the decoctions of leeks, onions, raisins, and figs, sorrel, wood sorrel, water gruel, barley water, and rice gruel, orange juice, hops, tea, and especially raisin and elder wines, and cyder.”

However, all these vegetables act very slowly on the stone. Whence the urine ought to be medicated many months by a plentiful diet on such vegetables, in order to render the stone in the bladder friable, and to produce any considerable effect. Hales observed that the pulp of onions, and the juice thereof  
mixed



mixed with water acted very powerfully on the human stone; and thence concluded that a plentiful use of onions would entirely dissolve a stone in the bladder, or least prevent its further growth. A further reason why the effect of the above remedies must be slow, is their being mixed with the urine: for Hales has taken notice, that human stones are dissolved by long maceration in water, and are covered over with a white mucous matter; but that the dissolution thereof did not succeed so well, if only one fortieth part of urine was added the water, though the glass, containing the stone and water mixed with urine, was set in hot dung.

Hence to prevent the formation of renal stones, Zecchius, as Baglivi informs us, recommended a plentiful draught of warm water, about a pint to be drank immediately before dinner. Piso, and Alexander had advised the same remedy many years before; who affirmed, that after the voiding of the first stone, they had never known any more formed in persons who regularly pursued the above method. And as a much greater quantity of warm water can easily be borne by an healthy person, many have prescribed it several times a day with considerable advantage.

Whey prepared from the milk of animals fed on vegetable food alone, is justly preferable to that prepared from the milk of stall fed beasts, as besides a great quantity of watery particles, the solvent virtue of grass is contained therein. I have known calculous concretions in the gall-bladder and billiary ducts happily dissolved by a plentiful use of ptizans and whey prepared with grass. And Sydenham always at night drank plentifully of small beer, to relieve the nephritic complaints under which he laboured.

That

That the solids of the human body are relaxed by aqueous liquors, particularly when drank warm, is an incontrovertible fact; and especially the kidneys, through which a large quantity of aqueous urine constantly flows. Among the causes of a stone in the kidneys, a too great laxity of the kidneys has been enumerated by some authors; who were apprehensive, that some grosser fluid than that intended by nature would be secreted through the relaxed renal canals, which might afford the basis of a stone, if it should lodge in the pelvis, or its branches. But the continual and more copious stream than usual, of thin, watery urine must cleanse away any adhering matter. Whence there seems no likelihood of such an accident.

Many also have apprehended a general debility of the habit, relaxed by an emollient and spare diet: for Lobb directs, that "stone patients should wholly abstain from animal food, and the plentiful use of aqueous liquors;" and not without reason. But this disorder is trivial, compared with the tortures of a renal stone, and may easily be remedied after the stone is cured. And the languid state of the body that happens, in consequence of a long continued use of such a diet, is considered by Boerhaave as a good omen. "The use of these, continued till the body becomes loose, and remains so a good while, is highly serviceable, though some debility should ensue therefrom; for this favourable symptom frequently resolves even an inveterate disorder."

Helmont is of opinion, that a plentiful use of sea salt never hurts a stone patient; "but, on the contrary, that he has seen many who, by a plentiful use of salt, have prevented the further growth of a recent and increasing stone." In another part of his works, he extols spirit of sea salt taken in white  
H wine,

wine, which medicine, he says, " not only removes  
 " the fatal stranguries, to which old people are sub-  
 " ject, but also in persons where a stone has been  
 " lodged several months in the bladder, by the use  
 " thereof, the stone has been, at length, lessened in size,  
 " and voided by the urinary passage, which, before  
 " the patient had taken spirit of sea salt, having fre-  
 " quently entered the beginning of the urethra, had  
 " as often been obliged to be forced back into the  
 " bladder with a catheter."

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